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Experimental Researches

RESPECTING THE

Relation of Dress

To Pelvic Diseases of Women

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Experimental Researches Respecting the Relation of Dress to Pelvic Dis- eases in Women.

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For many years the assertion has been made by leading gynecologists, and concurred in by most physicians devoted to the treatment of diseases of women, that the modes of dressing in vogue among civilized women constitute an important ætiological factor in the production of various forms of pelvic disease peculiar to the sex. This belief, however, has been based largely, if not wholly, upon the somewhat inaccurate, and hence necessarily unreliable, data gathered from the study of diseases the causes of which may, and in fact usually do, include numerous elements, at least several of which commonly enter into any given case, making it necessarily quite impossible to assert with assurance that any particular cause has operated more powerfully than others in the production of the results observed. Recently, several valuable papers have been contributed to the study of this subject by Drs. Dickinson, Neftel, Mays, Walshe and others, and I desire in this paper to detail the results of some investigations which I have made, which I trust may add something to the scientific study of this question. These results I will consider under five different heads.

1. A comparative study of the function of respiration in civilized and uncivilized women. The means of investigation employed for exact comparison were the pneumograph and the kymographion, or recording cylinder.

2. Studies of the influence of respiration upon the pelvic organs, as shown by the tracings obtained by means of



an inflated air pessary in the vagina connected with a recording tambour and cylinder.

3. Observations upon the influence of constriction of the waist upon intra-pelvic pressure as measured by a peculiar form of mercurial dynamometer, to be described in this paper.

4. Observations of the amount of external pressure exerted by a tight corset, tight bands, or other form of constriction of the waist, as recorded by the dynamometer.

5. Direct measurements of the amount of displacement of the uterus produced by constriction of the waist, the measurements being taken with an instrument devised for this purpose.

Respiration in Civilized and Uncivilized Women.—Up to the present time, all standard authorities in physiology have been agreed that there are two distinct types of respiration in human beings, characteristic of the two sexes; namely, abdominal and costal, it being declared that adult males breathe chiefly with the lower portion of the chest, using the diaphragm and abdominal muscles freely, while women breathe chiefly with the upper part of the chest. In arriving at this conclusion, physiologists seem to have confined their studies of respiration in women wholly to civilized women, in whom the mode of dress is evidently well calculated to produce serious interference with the respiratory function. Nine years ago, referring to this alleged natural difference between the respiration of man and woman, I wrote as follows:—

“It is undoubtedly true that most women do breathe almost exclusively with the upper part of the chest; but whether this is a natural peculiarity, or an acquired, unnatural and depraved one, is a question which I am decidedly inclined to answer in harmony with the latter supposition, basing my conclusion upon the following undeniable facts:

1. “In childhood, and until about the age of puberty, respiration in the boy and the girl is exactly the same.

2. “Although there is a change in the mode of respiration in most females, usually soon after the period of pu-

erty, marked by increased costal respiration and diminished abdominal or deep respiration, this change can be accounted for on other than physiological grounds.

3. "I believe the cause of this modification of respiration is the change in dress which is usually made about the time of puberty. The young girl is now becoming a woman, and must acquire the art of lacing, wearing corsets, 'stays' and sundry other contrivances which will aid in producing a 'fine form.'

4. "I have met a number of ladies whose good fortune and good sense had delivered them from the distorting influence of corset-wearing and tight-lacing, and have invariably observed that they are capable of as deep respiration as men, and practice it naturally.

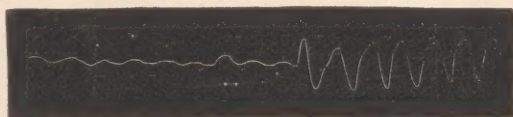
"I am thoroughly convinced that this so-called physiological difference between man and woman is really a pathological rather than a physiological difference. In short, I believe that the only reason why women do not, under ordinary circumstances, breathe as do men, is simply that they cannot breathe naturally."

Since writing the above, I have made many observations which confirm the views expressed. I long ago determined, however, to make a more exact study of the subject, should opportunity ever be afforded me to observe respiration in the women of Indian tribes or other races who have not adopted the habits of civilization as regards dress. Last year my attention was called to a series of very interesting observations made by Dr. Mays, of Philadelphia, upon the respiration of Indian girls in the Lincoln School at Philadelphia, in which a graphic representation of the movements of the chest was obtained by the aid of a pneumograph. Through the courtesy of Dr. Mays, I was able to provide myself with a pneumograph, and with the aid of a watch repairer, constructed a kymographion, or recording cylinder, which, though far from being a perfect instrument, has served its purpose very satisfactorily while I have been waiting for the construction of a more elaborate and perfect instrument. Equipped with this instrument, and armed with

a letter of introduction from one of the United States Indian Commissioners, I started for the West, determined, if possible, to settle this question. Other business which I had on hand led me first to San Francisco, where it occurred to me that the peculiar and wholly unrestricted mode of dress of Chinese women would render them proper subjects for the investigation also. I accordingly began work in Chinatown, where I obtained subjects for observation through the courtesy and influence of the Chinese Consul-General, Colonel Bee. I observed the respiration in twenty Chinese women, the most of whom were inmates of the home for Chinese girls, under the charge of Miss Culbertson, who showed me every courtesy, and rendered most valuable assistance in obtaining the tracings.

Before saying anything as to the results, a word respecting the dress of Chinese women will be in place. The Chinese woman knows nothing of corsets, waist-bands, or heavy skirts. Her dress consists of a few simple roomy garments—a loose frock or chemise, and a very short bodice reaching just to the under side of the breast, intended only to support the breasts and not compressing the waist in the slightest degree. Aside from the stockings and shoes, the two chief garments in addition to those mentioned, are the trousers and a very roomy jacket, which I am sure any American woman would pronounce large enough for three or four persons. The trousers are provided with a wide selvedge around the top, which is used for supporting the garment, being loosely kept in place by a silken band tied around the body just above the most prominent portion of the hips. The Chinese woman of low caste has in her wardrobe no garment which can in the slightest degree restrict any movement or function of her body. The aristocratic Chinese woman, however, as it is well known, cripples her feet by bandaging so that they become almost useless, but would consider it a gross immorality to apply any constriction about the waist.

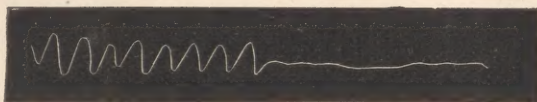
Now as to the results of the observations of respiration in Chinese women. Of the twenty women examined, vary-



Costal.

Abdominal.

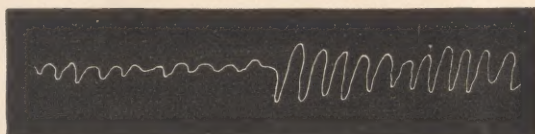
Fig. 1. Man.



Costal.

Abdominal.

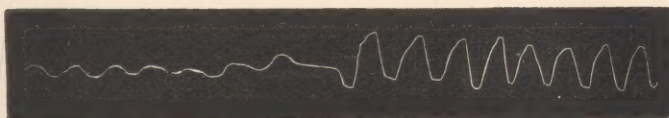
Fig. 2. Civilized Woman (Unmarried, age 33 years).



Costal.

Abdominal.

Fig. 3. Chinese Woman.



Costal.

Abdominal.

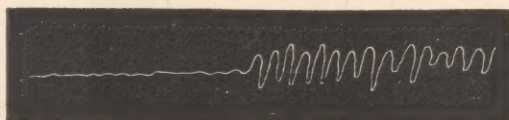
Fig. 4. Indian Man (Chickasaw).



Costal.

Abdominal.

Fig. 5. Indian Woman (Chickasaw).



Costal.

Abdominal.

Fig. 6. Chippeway Indian Woman.

ing in age from sixteen to thirty years, not one had ever worn a corset or any constriction of any sort about the waist, and not one presented the costal type of respiration. In every one, abdominal breathing was as prominent as in males who lead sedentary lives. For the purpose of comparison, I exhibit a pneumographic tracing of costal and abdominal respiration in a man of vigorous habits. Abdominal respiration in men, even, is always very much more marked in those whose habits are active, particularly pedestrians and long-distance runners, than in those whose habits are sedentary.

Fig. 1 is a tracing obtained from a man of vigorous habits, when breathing without voluntary effort.

Fig. 2 exhibits the respiratory movements, costal and abdominal, of a civilized woman of 22 years, who has for eight years been addicted to tight-lacing, and habitually wears a corset.

Fig 3 is a fair average of the tracings obtained from the Chinese women. The average Chinese woman of San Francisco leads a very inactive, and, for the most part, a very unhealthful life. Nevertheless, her dress is healthful, and she breathes normally.

My next observations were made among the Yuma Indians at Fort Yuma, Arizona. The Yuma Indians are the most primitive of any tribe now living in the United States. Their houses are miserable mud huts, their clothing as little as possible, consisting, with the women, of simply a short bark apron in front, and a bunch of bark strings, somewhat resembling a bustle, behind, both suspended by a bark cord encircling the body just above the hips. With this sort of dress, the movements of the Yuma woman cannot be in the slightest degree restricted. She has as perfect liberty of motion in her arms, legs and trunk as has her savage lord, whose apparel is a little more scanty, consisting of a narrow belt about the loins, to which is attached, before and behind, a piece of bark or cloth, about the width of the hand, passing between the thighs. Many of the women of this tribe, as well as the

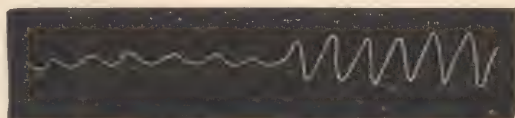
men, have remarkably good physiques. An active, out-of-door life is a matter of necessity with them, as they receive no support from the government, living still upon their own original possessions, and subsisting upon the pods of the mesquit bean, a variety of seeds which grow spontaneously, and the pumpkins, squashes, melons, and a few other vegetables which their scanty agriculture furnishes. Some of the more civilized are employed as laborers by neighboring settlers, and are able to provide themselves with corn or corn meal, from which they prepare the tortillas, in the manner common among the Indians of Mexico. The scanty bill of fare of this people might be regarded as insufficient to secure vigorous physical development, but the testimony of white settlers who have had opportunity for observing them closely, is that they were much freer from disease while living in their primitive conditions than after adopting the habits of civilization.

Measurements which I took of these women show the circumference of the waist to be, on an average, scarcely more than one and one-half inches to two inches less than that of the chest. A wide contrast with the corset-compressed waist of the civilized woman. Among the Yuma women whose tracings I obtained were a grandmother, a daughter, and a granddaughter whose ages were respectively about sixty, thirty-seven, and sixteen. The tracings of the three were practically identical, all giving strong abdominal curves, showing the male type of respiration.

I next visited the Indian nation, where I took tracings from a number of Chickasaw women. Figures 4 and 5 represent respectively the respiratory movements of a young man and a woman of this tribe. The curves are practically identical in the two.

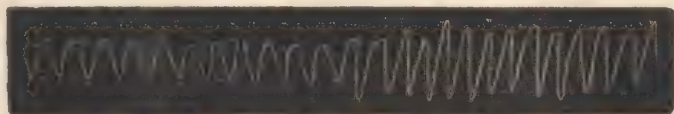
Fig. 6 is a tracing obtained from a Chippeway Indian woman who wore a loose dress, and had never had a corset on. Her mode of breathing is certainly decidedly masculine.

Fig. 7 is of interest in this connection, as it represents the respiratory movements of a civilized woman of Scotch



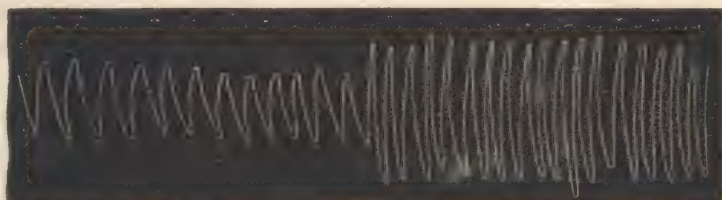
Costal. **Abdominal.**

Fig. 7. A Scotch Woman, who has never worn a corset (age 45, unmarried).



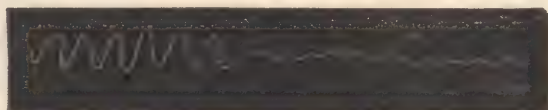
Costal. **Abdominal.**

Fig. 8. A Reformed Corset-wearer (ordinary respiration)



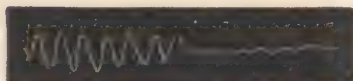
Costal. **Abdominal.**

Fig. 9. Reformed Corset-wearer (forced respiration).



Costal. **Abdominal.**

Fig. 10. Young Woman in Corset.



Costal. **Abdominal.**

Fig. 11. Man in Corset.



Costal. **Abdominal.**

Fig. 12. Male Dog.



Costal. **Abdominal.**

Fig. 13. Female Dog.

birth, who, at the age of forty-five years, at the time this tracing was taken, had never in her life worn a corset or other means of constricting the waist, and had been wholly free from the pelvic disorders to which a large share of the members of her sex in civilized lands are subject. As will be readily seen, the respiratory movements in this case are very different from those of the ordinary civilized woman, and are decidedly abdominal in type.

Fig. 8 is equally interesting as representing the respiratory movements of a woman thirty years of age, who, until her twenty-fourth year, was subjected to the damaging influence of corsets, tight waist-bands, heavy skirts, and the evils of modern fashionable dress. Finding herself seriously crippled with grave pelvic disorders, and broken down in health, and after unsuccessful efforts to recover her health by other means, she abandoned all medical treatment, adopted healthful dress, entered a gymnasium, and subjected herself to a thorough course of physical culture, giving special attention to the development of the waist and abdominal breathing; and as the result, as shown by the respiratory curves exhibited, she has so far overcome the artificial mode of breathing which she had previously acquired as to exhibit at the present time respiratory movements as decidedly abdominal in type as those of the most savage woman of the forest.

Fig. 9 shows the curves produced in forced respiration by the same person.

Fig. 10 shows the curves produced by a young woman wearing a corset. There is almost no movement of the lower part of the chest although she evidently made an effort to use the lower part of the chest.

Fig. 11. A tracing showing the respiratory movements of a man with a corset on. This tracing is exactly the reverse of that obtained from a man with ordinary clothing.

The reason assigned by physiologists for the supposed female type of respiration is the fact of gestation in woman. It is a very natural supposition that the increase of the abdominal contents which occurs in pregnancy has a tendency to

lessen the movements of the lower portion of the chest, and the conclusion that the frequent occurrence of this condition in woman will finally result in the establishment of the permanent habit of breathing in this manner, is very easily reached. Nevertheless, observations which I have made with the pneumograph seem to contradict this view, and I offer the following facts in support of the assertion that gestation does not necessarily imply the establishment of a peculiar type of respiration in women :—

1. I have already shown that in Chinese and Indian women, even those who have borne children, the respiration is of the so-called male type.

If gestation exerts so powerful an influence of this sort in human beings, the same cause should produce the same result in lower animals. Walshe has shown that respiration in cows and female dogs is the same as in males of the same species. I have myself taken pains to obtain tracings from dogs, which I here exhibit.

Fig. 12 shows the costal and abdominal respiration of a male dog.

Fig. 13 was obtained from a female dog.

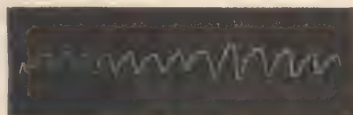
In both instances the animals were quiet when the tracings were made.

3. As has already been shown, civilized women who have never worn a corset or tight clothing, breathe abdominally, as do men; and civilized women who have formerly worn corsets or tight clothing, after having modified their dress in accordance with the demands of health, subsequently acquire the abdominal type of respiration.

4. I have obtained the tracings from two women who were pregnant, one of which I exhibit herewith.

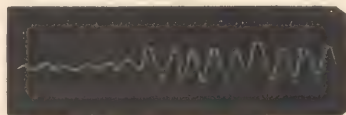
Fig. 14 shows the respiration of a woman in the seventh month of pregnancy. Had worn a tight corset until within a few weeks.

Fig. 15 represents the breathing of a woman one week before confinement. This woman, a primipara, had previously worn tight corsets for ten or twelve years. She had laid aside her corsets, however, and had been wearing



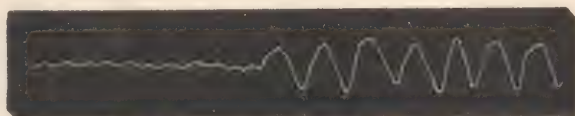
Costal. Abdominal.

Fig. 14. Woman at Seventh Month of Pregnancy.



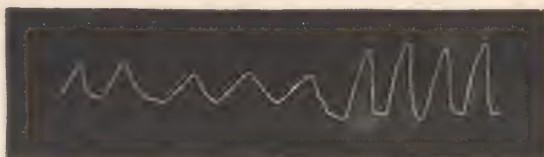
Costal. Abdominal.

Fig. 15. Woman, a Week Before Confinement.



Costal. Abdominal.

Fig. 16. Man with Enlarged Spleen.



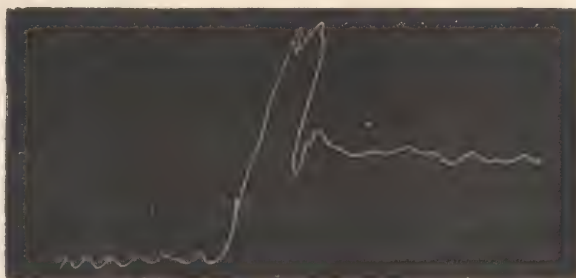
Ordinary. Forced.

Fig. 17. Respiratory Tracing (Vaginal).



Ordinary. Forced.

Fig. 18. Vaginal Tracing, with Corset.



Without Corset. Tightening Corset. With Corset.

Fig. 19. With and Without Corset.

her clothing loose as possible for several months. As the result, we see that notwithstanding the presence of advanced gestation, abdominal respiration is well pronounced.

When taking the last mentioned tracing, I happened to have under treatment a patient suffering from leucocythemia, with an enormously enlarged spleen. The man's abdomen was as large as that of a woman eight months advanced in pregnancy. It occurred to me that it would be instructive to obtain a tracing of a male in a condition analogous to that of pregnancy, as regards the increased volume of the abdominal contents.

Fig. 15 represents the respiratory movement of this patient. Here, also, the abdominal type is very marked.

It is certainly a just conclusion from these facts that *the so-called female or costal type of respiration, which prevails among civilized women, is the result of their restricting and unphysiological mode of dress, and is not due to the influence of gestation.* My purpose in the introduction of these facts into this paper, is to lay the foundation for the view that there is an important relation between the artificial mode of respiration in civilized women and the development of various forms of pelvic disease, particularly uterine and ovarian congestion and displacements.

Influence of Respiration upon the Pelvic Organs.—I wish now to call attention to some observations upon the influence of the respiratory movements upon the pelvic organs. These observations were made by means of an air pessary connected with a tambour, such as is used in connection with a pneumograph, the movements being recorded upon the revolving cylinder.

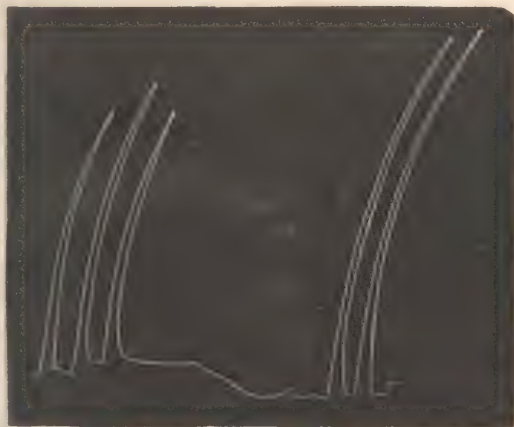
Fig. 17 exhibits the movements of the pelvic organs produced by respiration, ordinary and forced, in a patient in a horizontal position, and without constricting bands of any sort.

Fig. 18 shows the movements of the pelvic organs resulting from ordinary and forced respiration, patient horizontal, as before, but wearing a corset moderately tight. The difference between the two tracings is noticeable in

that the movement of the pelvic organs is less when the corset is tight than when it is loose. The reason for this is made apparent by the tracing shown in Fig. 19, the first part of which shows ordinary respiration without a corset; the last part, ordinary respiration after the corset has been applied. The sudden elevation in the center of the tracing indicates the downward movement of the pelvic organs occasioned by the tightening of the corset.

Fig. 20 shows the same thing, and also exhibits the influence of coughing upon the pelvic organs. The enormous curves produced in the act of coughing indicate a corresponding amount of displacement of the uterus and its annexa in a downward direction. Another point in this tracing to which I wish to direct attention, is the greater amplitude of movement when the corset was loosened, which coincides with what is learned by comparison of the tracings shown in Figs. 17 and 18, or the first and last portions of Fig. 19. This lessened amplitude of movement at first surprised me; but on consideration, the reason is plain. It is due to two causes: (1), The compression of the abdominal wall crowds a portion of the abdominal contents upward, while another portion is crowded downward. By this displacement of the viscera, the movements of the diaphragm are restricted. This muscle not being able to descend to the usual degree, there is less movement of the pelvic viscera than without the corset. (2), The degree of easy mobility of the uterus in the direction of the longitudinal axis of the body, is lessened by the compression of the corset, as shown by Fig. 19. Consequently, the excursions produced by ordinary respiratory movements, or by the extraordinary movements of forced respiration, coughing, etc., are necessarily more limited under the restricting influence of the corset than without it.

Fig. 21 shows the relative influence of different positions of the body upon intra-pelvic pressure. It will be noticed that the greatest change in pressure occurs in rising from the horizontal to a vertical position, and in assuming the genupectoral position. The facts elicited by



With Corset.

Without Corset.

Fig. 20. Coughing (Vaginal Tracing).



Backward.

Forward.

Fig. 22. Influence of bodily movements upon Intra-pelvic Pressure.



Standing.

Sitting.

Lying on Back.

Lying on Side.

Lying on Face.

Knee-Chest Position.

Fig. 21. Influence of Position on Intra-pelvic Pressure.

the tracing agree precisely with what have been held as accepted facts, but for which we have heretofore had no scientific or exact representation, for which reason chiefly I offer them as being of interest.

Fig. 22 exhibits the influence of certain movements of the body upon intra-pelvic pressure. It is noticeable that bending backward increases the pressure, while bending forward lessens the pressure. Under the influence of a tight corset, the amount of pressure induced by bending backward is increased, while the decrease of pressure in bending forward is greatly lessened, or more than neutralized, by the pressure of the corset over the lower portion of the abdomen.

The facts of interest elicited by my observations of the influence of respiratory movements upon the pelvic viscera, present themselves as follows:—

1. There is a normal movement of the pelvic viscera corresponding to those of respiration.

2. These movements are lessened by constriction of the waist, inducing the costal type of respiration, as the result of two factors, (*a*), the lessened movements of the diaphragm, and (*b*), the downward displacement produced by the pressure of the corset upon the abdominal walls.

Observations upon the Influence of Constriction of the Waist upon Intra-Pelvic Pressure.—The tracings which I have exhibited show merely relative pressures. No definite numerical value can be attached to any of the curves obtained in the manner described. In order to obtain at least an approximate idea of the amount of pressure to which the pelvic organs are normally subjected, and to which they are subjected by the wearing of the corset or other constricting articles of dress, I have made a number of observations by means of an instrument which I have termed a universal mercurial dynamometer, from the fact of its adaptation to the determination of the force of movements of almost every description. I have had this instrument in use for a number of years, but as I have never before written an account of it, a brief description may be

in order. The instrument utilizes the mercurial column as the means of measuring the force exerted. As shown by the accompanying cut (Fig. 23), the instrument consists of the following parts:—

1. A cistern about two-thirds filled with mercury, the remaining space being filled with water.

2. A glass tube of a caliber of about one-thirty-second of an inch, and six feet in height.

3. A rubber bulb connected by a tube with the space above the mercury in the cistern, and both completely filled with water.

4. A bottle partly filled with water, placed two or three feet above the cistern, and connected with the upper part of the cistern by a rubber tube. A pinch cock controls the connection between the bottle and the cistern. The purpose of this arrangement is to keep the upper portion of the cistern completely filled with water, and also to raise the height of the column to any desired point before applying pressure to the bulb, when desirable to do so.

5. An adjustable, graduated scale, erected beside the glass tube, reaching to the level of the mercury in the cistern.

6. A framework by which the apparatus is sustained.

In use, compression is made upon the rubber bulb, by which water is forced into the cistern, displacing an equal quantity of mercury, which rises into the glass tube until a height is reached at which the pressure upon the inside of the bulb is equivalent to that upon the outside. By means of simple arrangements for the purpose, the strength of every group of muscles in the body, except the smallest and most inaccessible muscles, can be readily tested by this apparatus, and it is for this purpose chiefly that I have employed it. In using the instrument for testing intra-pelvic pressure, I have simply to replace the bulb ordinarily employed by an air pessary which has previously been placed in the vagina and filled with water. I have made many measurements with this instrument in this manner, and have obtained some most interesting results,

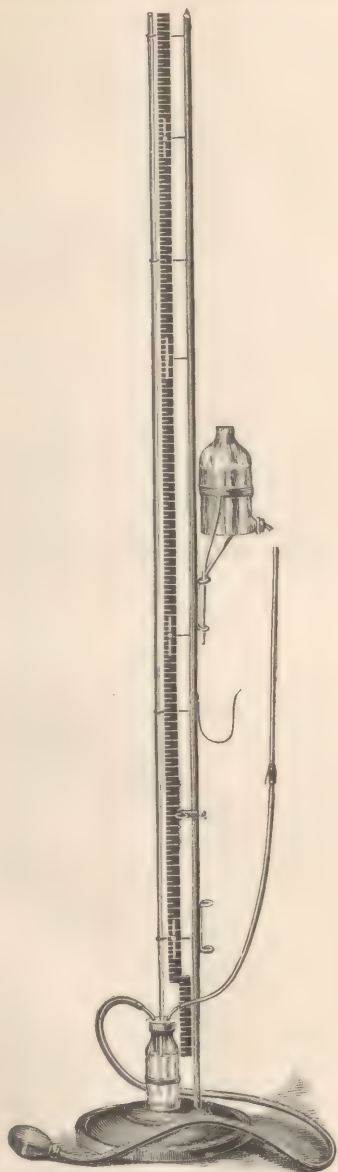


Fig. 23.
Universal Mercurial Dynamometer.



Fig. 24.
Instrument for measuring movements of
the Uterus.

which I have tabulated. Without reviewing the whole number of measurements recorded in my tables, I will present the following, which have a most important relation to the subject under consideration:—

The measurements were taken with the patient in three positions, lying, sitting and standing, and both with and without a corset in all these various positions.

In a case which may be considered an average case, a young woman of twenty years of age, starting with an initial pressure of eight-tenths of an inch of mercury, with the patient lying down, the mercurial column was raised in ordinary breathing from .01 to .05 of an inch by each respiratory movement. In forcible respiration, the mercurial column was raised from .35 to 1.7 inches.

Such acts as laughing, coughing, or blowing the nose, raised the mercurial column from 1 to 4.1 inches. When the initial pressure was 1.5 inches, bending forward lowered the column from .2 to .5 inches; bending backward raised it 2 inches.

On tightening the corset, the mercurial column was raised .5 of an inch. In forced respiration, from .2 to .5

Rising to a standing position, the initial pressure increased .5 inches, and other pressures increased in proportion. I have not yet pursued these studies as far as I desire to do, and hope to perfect my apparatus so as to be able to obtain a very accurate idea of normal intra-pelvic pressures, and the extent to which aberrations from the average normal pressures are possible; but I think I have, at least, shown that variations in pressure, corresponding to the tracings made by the recording tambour and kymographion, represent changes which are very considerable in degree and of important pathological import. This will be more fully appreciated, perhaps, when it is remembered that an inch of mercury represents about one-half pound pressure, and that even so small a pressure as .5 of an inch of mercury, or four ounces avoirdupois, amounts to a very considerable aggregate when applied to every square inch of the pelvic floor.

Measurements of the Amount of External Pressure Exerted by Corsets, Tight Bands, and other Constricting Articles of Clothing.—As the result of a large number of observations, I have found the average pressure exerted at the waist by a tight corset or tight waist bands to be, in ordinary respiration, about .3 of an inch of mercury. In forced respiration, I found the pressure exceedingly variable, ranging from one to twenty inches, the equivalent of which, in pounds, is about one-half to ten pounds per square inch. In taking these measurements, the bulb of the dynamometer was placed underneath the corset, next to the body, and, of course, the results given do not represent accurately the amount of pressure exerted within the abdominal cavity or pelvis; nor is it to be supposed that the force indicated is exerted on every square inch of the entire area of the corset, but only over the area of the greatest constriction.

Direct Measurement of the Amount of Displacement of the Uterus Induced by Constriction of the Waist, etc.—Finding no convenient method of measuring the actual amount of movement of the uterus along the axis of the body, I have devised an instrument (see Fig. 24) by means of which the movements of the uterus in a perpendicular direction are so magnified as to render apparent slight movements of ascent or descent which might otherwise escape detection. The action of the instrument will be easily understood from the accompanying cut. By means of this instrument I find that the movements of the uterus up and down in ordinary breathing are from .1 to .3 of an inch. Coughing or deep breathing, straining, and similar movements may increase this to .5 of an inch. By the application of the corset, or other constricting means, I find the uterus is lowered in the pelvis from .2 to .5 of an inch.

A Newly Observed Function of the Round Ligaments.—Although I make no pretensions to profundity of knowledge, either as a physiologist or an anatomist, I wish to call attention to what I believe to be a new observation

respecting the functions of the round ligaments. The literature of these organs is so scanty that one is tempted to believe that they have been somewhat neglected by anatomists, which might, perhaps, be considered at least very natural, since it seems to be only within the last half dozen years that these organs have come to be considered as of any very particular account in the system of woman. Since the announcement by Dr. Wm. Alexander, of Liverpool, of the results of the operation known by his name, and which consists in the shortening of the round ligaments, these organs have probably been studied more and more carefully than for half a century before. I was first led to studies of the round ligaments by interest in the operation referred to, in preparing for which I made careful dissections upon the cadavar of the region in which these structures lie. According to Gray, "The round ligament consists of areolar tissue, vessels and nerves, besides a dense bundle of fibrous tissue and muscular fibres prolonged from the uterus." Some observations which I have made have led me to the conclusion that the round ligaments contain, in addition to the structures named, striated or voluntary muscular fibres. I base this belief on the following facts:—

Several months ago, wishing to test the possible therapeutic value of electricity in the treatment of uterine displacements, and to determine, if possible, the comparative value of different forms of current, I applied to the ligaments, in the course of an operation for shortening of them, the galvanic, faradic and a reversing dynamic current. I found that the ligaments contracted readily with all forms of current, when either or both poles were applied to them. The ligaments, which were well drawn out and separated from their attachments in the canal, were not only drawn back into the body, but were contracted in their length. I observed, also, that the contraction of the ligament was nearly, if not quite, as vigorous when the electrodes were not applied directly to them, especially when the electrodes were placed, one in the vagina and

the other upon the abdominal wall a few inches from the ligament. When the electrodes were thus placed, there was an energetic contraction of the ligaments whenever the abdominal muscles were made to contract by closing the circuit. That the contraction was not simply in appearance, I proved by cutting off a couple of inches of a ligament, and placing it upon a moist napkin, when it still continued to contract whenever the current was applied. This portion of ligament I placed in alcohol and afterwards examined, and found imbedded in its structure a large fasciculus of striated muscular fibres, each measuring about one-seven-hundredth part of an inch in diameter.

Quite recently I have verified this observation in a case in which the ligaments were unusually well developed, and with the same result. After drawing a ligament well out and freeing it completely from all fascia and surrounding structures, I held up the loop of ligament and carefully applied a mild faradic current. The contractions resulting were prompt and vigorous, and characteristic of voluntary muscle, very different from the sluggish response of non-striated muscles.

These observations, and other considerations, have led me to the conclusion that the round ligaments, so called, are really much more properly to be classed as muscles than as mere ligaments. Certainly they behave to the electrical current as muscles, although to the touch, and under the microscope, they usually present a much tougher and denser structure than do ordinary muscles. And why should not these organs contain voluntary muscular fibres? They are the physiological analogues of the spermatic cords in the male which are provided with voluntary muscles.

But the suggestion may be made that a necessity exists for voluntary muscular fibres in man which does not exist in woman. To this I reply that if voluntary fibres are essential or useful in man, they must be far more so in woman. I have seen no discussion of the special relation of the functions of the cremaster muscle to the safety

or the functional activity of the testicles, but I conjecture that the purpose of these muscles may be to prevent too great dragging down of these organs when made heavy by engorgement with blood when lifting, coughing, or straining at stool, to which danger they are constantly exposed on account of the immediate connection of their veins and arteries with the large vessels of the trunk. Any one who will take the pains to observe will notice that the testicles are always drawn up during such acts as lifting, or other forms of muscular movement, which involve strong contraction of the abdominal muscles so as to produce downward pressure. By this means, the blood-vessels are gathered up and folded in such a manner that they cannot become greatly engorged with blood unless they have previously become varicose. I can understand that the cremaster may be of great service to the testicle in this manner.

Now let us see of how much greater service a contractile round ligament may be to the ovaries and uterus. Normally, the ovaries are placed above the rim of the pelvis and wholly out of the current of downward action. The uterus is placed at such an angle with the vagina that it rests upon the bladder and is forward of the current of downward action, so that little force is required to sustain it in position. In such acts as coughing, lifting, straining at stool, etc., the contraction of the abdominal muscles, and the consequent downward pressure, have a tendency to force the uterus backward and downward. When the fundus falls backward to such a degree as to allow the top of the organ to be engaged by the intestines, it is crowded down into the hollow of the sacrum with very great force. By what means is this occurrence prevented in a woman whose uterus remains in a normal position? The round ligaments have received small credit for duty done in this direction. Dr. Alexander pointed out the interesting and important fact that they act as mooring ropes. This they certainly do, but it is a legitimate conclusion from my observations, as it seems to me, that they are something

more than mooring ropes. The value of the round ligament as a means for the prevention of backward displacement was long overlooked in consequence of the fact that they are ordinarily found in a slack condition. This fact would certainly militate greatly against their usefulness as mooring ropes, if they act simply as tendinous cords, as it would allow so great excursions in a backward direction as to seriously endanger the position of the uterus. If, on the other hand, it is conceded that the round ligaments are muscular structures capable of voluntary contraction, and that they do contract at the same time with the abdominal muscles when the latter are thrown into violent action, this difficulty disappears, and we see a very useful purpose in this arrangement. A muscle continually on the stretch loses its efficiency. It becomes tired out and stretches so as to become useless, or takes on atrophic changes. The slack of the round ligaments gives them opportunity to rest. When their services are required, the same nervous impulse which produces the imperiling action of other strong muscles, calls these muscles into play also. The slack is taken up, and the retreating fundus is snatched forward in time to prevent any harm being done. An ocular demonstration of this action would be difficult; and this view agrees exactly with what I have seen occur in response to the stimulus of electricity.

Another element of proof to which I wish to call attention is the fact that the muscular fibres are to be found in women of middle age. An unused muscle undergoes degeneration. Is not the very fact of the existence of voluntary fibres proof of their functional activity?

[Since this paper was written I have made other tests of the condition of the round ligaments, and in two instances found them non-contractile. In both cases the patients were unmarried women, nearly thirty years of age, who had suffered from extreme retroversion for at least eight or ten years. Evidently, the round ligaments had undergone degeneration. They were very slender and brittle, and seemed to be nothing more than membranous

bands. In these cases, the ligaments had been in a state of enforced idleness, and degeneration was the natural result.]

Since the first edition of this reprint was published, in making further researches, I find, on page 160, vol. 1, of the "*American System of Gynecology*," the following statement which wholly confirms my observations respecting the structures of the round ligaments, although I have added the evidence afforded by the electrical test of the functional activity of the ligament as a voluntary muscle:—

"Rouget claims to have found striated muscular fibres in the areolar tissue covering the lower end of the ligament; he says that they are derived from the transversalis muscle. Sappey says that 'striated fibres come from the lower part of the inguinal canal and from the pubic spine, and ascend to the uterus, but generally disappear at the level of the superior strait.' These, he affirms, are surrounded by the layer of smooth muscle derived from the uterus, "like the sleeve of a coat."

If it be granted, then, that the round ligaments are muscular structures, and that they serve an important purpose in their muscular activity by the prevention of uterine and ovarian displacements, it will at once become apparent in what manner the wearing of the ordinary mode of dress may become productive of this class of maladies through interference with the proper action of the round ligaments. As the ligaments are by their nerve connections made to contract at the same time as the abdominal muscles, it is evident that anything which interferes with the free action of the abdominal muscles must equally interfere with the action of the round ligaments. This a corset, or tight waist-bands, will most certainly do. In a woman who has long worn a corset, the abdominal walls are lax, soft, and of feeble muscular power. The round ligaments of such a woman must necessarily be in the same condition. I have performed the operation of shortening the round ligaments more than fifty (now sixty-eight) times on living women, and I have never in a single instance found well-developed

round ligaments in a woman whose abdominal muscles were poorly developed. I do not hesitate to predict that well-developed round ligaments will be found in a case in which there is a good muscular development of the muscles of the trunk, except in cases in which the retroversion has existed so long as to occasion degeneration. This fact also emphasizes the importance of thorough physical culture in girlhood, as a means of prevention of the numerous and increasing maladies to which so many women in civilized lands are subject.

It is common to speak of woman as the weaker vessel; but I can see no reason why a well-developed woman may not equal in endurance a man of the same size and development. This is generally true as regards the males and females of lower animals. I have been assured by experienced horsemen that mares are superior in endurance to horses of the same size and breed. Several years ago, when in Italy, I frequently saw teams composed of a horse, an ox, and a cow, contentedly pulling a heavy load along the road, and the cow held her own with the rest of the team. Among savage tribes, the women do most of the hard work. The Mexican woman cultivates the ground, cares for her household, cooks the meals and makes the clothing for her lazy lord, rears her children, and when moving-day comes, trudges off with all her household goods piled upon her shoulders, and the younger members of her family on top of all. Stanley says that the strongest and most enduring porters he found in Africa were women. In Germany, the peasant woman toils beside her husband in laborious employments, and appears to be as healthy as though she were a man. In France, I found it a common thing to see a line of men digging a trench for a water-pipe, and a woman at the head of the line breaking ground. I am satisfied that imperfect and unsymmetrical physical development is a cause which lies at the foundation of a large share of the sexual diseases to which American women are subject, and much of this must be charged to the wearing of clothing which renders the

healthful activity of the muscles of the trunk an impossibility.

Another manner in which a mode of dress which interferes with abdominal respiration acts as a cause of pelvic disease in women, is the partial immobility of the uterus and its appendages which is induced, as indicated by the tracings and dynamometric measurements presented in this paper. The rythmical movements of the diaphragm in abdominal breathing serve to maintain a healthy activity of the circulation in the pelvis, as well as in the abdominal organs. Indeed, the diaphragm appears to act as a double pump, drawing blood toward the heart at the same time that it draws air into the lungs. Its influence upon the portal circulation and the venous system of the pelvis is second only in importance to its respiratory function.

When the uterus and ovaries are deprived of this aid to their venous circulation, congestions of these organs are a natural and necessary consequence. This natural tendency is also greatly aggravated by the deleterious effects of tight-lacing and costal respiration upon the functions of the liver. Jaundice and other functional diseases are much more frequent in women than in men. The compression of the corset, or of tight waist-bands, falls exactly over the liver. Within a month I have met a case in which the liver was almost entirely below the lowest rib. The patient confessed to me that when a young woman she had been in the habit of dressing very tight, wearing a tight corset to bed, so as to be sure to develop a form of approved shape. The liver was hour-glass in shape, and the lower section reached the upper portion of the pelvic cavity. It is not necessary to add that this woman has been a life-long sufferer from pelvic disease and functional disturbances of the liver.

Perhaps I ought not to close this paper without a brief reference to some of the conclusions reached by Dr. Mays, to whose studies of respiration I have already referred, as expressed in a very able and interesting paper on the relation of dress to consumption in women. Dr. Mays con-

cludes that while costal respiration is the result of the artificial mode of dress in vogue among civilized women, it is nevertheless advantageous as a preventative of pulmonary consumption. He quotes statistics to show that more men than women die of pulmonary consumption, and suggests that the tight clothing of civilized women may be a sanitary precaution which they have intuitively adopted as a protection from this grave disease, or as a sort of antidote to the many conditions favorable to the development of the disease to which they are exposed. While feeling very timid about criticising, or even questioning, the conclusions of so able an authority as Dr. Mays, the query has arisen in my mind whether the debility and disease resulting from tight clothing and costal respiration would not contribute far more to the production of consumption than could be counterbalanced by the enforced action of the upper part of the lungs induced by tight lacing. Is it not possible, also, that there are other causes, and those which are much more powerful, to which the lesser frequency of the disease in women may be fairly attributed? It seems to me that there are such causes, but I shall not undertake to discuss this question in this paper, which has already reached greater limits than I intended.

In conclusion, I wish to express the belief, that if civilized women would adopt some of the active physical habits of savage women, and would dress in such a manner as to secure to themselves the same freedom of muscular movement in every part of their bodies, they would be as free from pelvic disease as are the hardy women of the forest, who compete successfully with their brothers in the fierce struggles for existence which are ordinarily incident to an uncivilized life. Careful observation in the treatment of something more than five thousand cases of pelvic disease in women has convinced me that the development of the muscular system, and the cultivation of abdominal breathing, are among the most potent means of securing the radical and permanent cure of a very large proportion of this class of maladies.

